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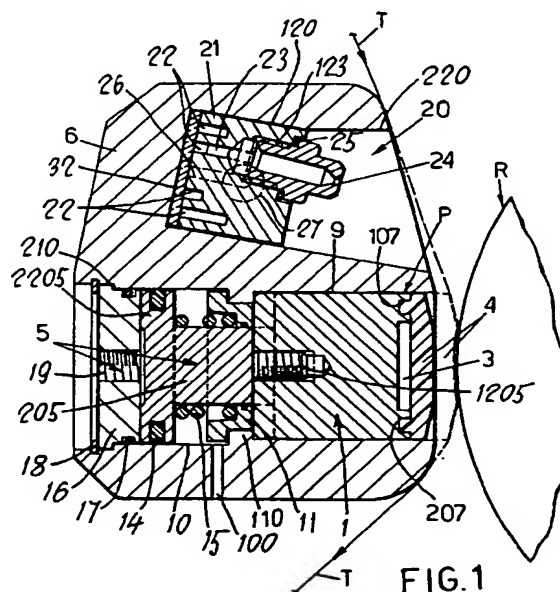
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**I-16124 Genova (IT)**(54) **Device for cleaning the rubber-covered cylinders of printing machines.**

(57) The device according to the invention comprises a presser which acts on the printing cylinder (R) with the interposition of a strong membrane (4) of elastomeric material, securely fixed, at least with its longitudinal edges, to corresponding supports of the presser bar (1). During the active phase of the operation of the presser, the membrane (4) is subjected to composite compressive, bending, tensile and other stresses, as a result of which the membrane acts on the printing cylinder (R) with a distributed pressure. On the cessation of contact with the cylinder (R), the membrane (4) returns by its own elasticity to its extended resting state. In combination with the elasticity of the membrane, advantage is preferably taken of the effect of pneumatic counter-pressure (110) to which the membrane is subjected when it is mounted with an air-tight seal on a corresponding chamber (3) of the presser bar (1).

**FIG. 1**

The invention relates to a device for the automatic cleaning of the rubber-covered cylinders, hereinafter referred to as the printing cylinders, of printing machines, of the offset or other type. Devices of this type are known from European patent applications 79103639.5, 88106842.3 and 88108928.8, and from the document US-A-4.344.361, all of which provide for the supply of liquid detergent to a cloth unwound from a reel and taken up on a powered roller. This cloth, with the detergent, is pressed against the printing cylinder which is to be cleaned by means of a presser parallel to the generatrix of the said cylinder. The devices known from the above documents are distinguished from each other essentially in the different types of pressers used, which may consist of a brush or an elastic membrane which seals a chamber into which compressed air is introduced to deform the membrane so that it presses the cloth against the cylinder to be cleaned. The presser may also be formed from a rubber bar fixed with uniformly distributed contact on a rigid bar which is moved parallel to the axis of the printing cylinder. In this case, advantage is taken of the elasticity of the rubber in compression.

Another presser, known from Italian patent application B092A-000092, combines the advantages of the preceding known solutions, without having their defects, and consists of a strong rubber membrane fixed in an air-tight way on a chamber in which atmospheric pressure is present initially, and which is formed in a rigid bar which, on command, is moved by suitable means parallel to the axis of the printing cylinder. In the course of the production of such a presser, certain modifications and improvements which form the subject of the present patent application were found to be useful; these relate to a special system of fixing the elastic membrane to the rigid supporting bar, which enables the transverse elasticity of the membrane to be exploited to the full, on its own or in combination with the counter-pressure following the reduction in volume of the air chamber sealed in an air-tight way by the said membrane. Other improvements consist in a special geometry of the elastic membrane and of the chamber sealed by the membrane, including as a function of the extension of the contact surface of the membrane with the printing cylinder.

The present patent application is also intended to protect a special structure for supporting and guiding the presser and for supporting the cleaning fluid spray bar, in order to obtain a rigid and lightweight device.

Further characteristics of the invention, and the advantages derived therefrom, will be clearly understood from the following description of some preferred embodiments of the invention, illustrated

solely by way of non-limiting example in the attached drawings, in which:

Fig. 1 is a transverse section through a cleaning device according to the invention for printing cylinders;

Fig. 2 is a front elevation of the presser;

Fig. 3 is a front elevation of the bar to which the elastic membrane of the presser is fixed;

Fig. 4 is a transverse section through a variant embodiment of the presser;

Fig. 5 is a front elevation of the bar to which the elastic membrane of the presser as shown in Fig. 4 is fixed;

Fig. 6 shows on an enlarged scale and in transverse section the active part of the presser in the resting state;

Fig. 7 is a transverse section of the active part of the presser in the operating state;

Fig. 8 is a graph of the bending moment to which the section of the elastic membrane loaded by the printing cylinder is subjected; and

Fig. 9 is a schematic view of the presser in longitudinal section, in the phase of action on the printing cylinder, and bearing on two supports symmetrically disposed on the rigid body of the presser.

Fig. 10 is a view like that of Figure 6, showing a modified embodiment of the presser.

In Figure 1, the letter P indicates the presser which, on command, presses the cleaning cloth T against the printing cylinder R. The presser is brought into contact with the cloth T by a strong membrane 4 of elastomeric material, fixed with a perimetric seal on a chamber 3 formed in a rigid bar 1 which, on command, is moved by suitable means 5-105 parallel to the axis of the printing cylinder. The presser constructed in this way is preferably housed in a guide cavity 9 formed in a rigid beam 6 supported and fixed at its two ends by suitable means. In the beam 6 are formed housings for the cylinder and piston actuators 5-105, of the fluid pressure type, numbering at least two, which act on the bar 1 with a symmetrical disposition and which, on command, cause the said movement of the bar 1, bringing it closer to the printing roller R and then moving it away from it.

In the beam 6, parallel to the presser housing cavity 9, is formed a longitudinal cavity 20 open on the front of the presser, in which cavity is housed a bar 21 with the nozzles 24 which spray the cloth T with liquid detergent, before the cloth reaches the presser and the printing cylinder.

According to the invention (see Figures 1, 3 and 6) the chamber 3 is delimited by at least two longitudinal edges which are raised and coplanar with each other, in which are formed, in a median position and longitudinally, continuous grooves 107-207 of suitable shape and size. In the attached

drawings, the grooves 107-207 have a rectangular or square section, but they may be shaped differently and for example may have a dovetail section, with the side walls converging together towards the outside of the groove. The chamber 3 is temporarily filled with a separating insert, after which the membrane 4 is fixed by vulcanization on the suitably cleaned and ground raised edges of the said chamber, part of the membrane engaging in the said grooves 107-207, preferably filling them completely, so that the said membrane is securely fixed with its longitudinal edges to the corresponding edges of the chamber 3 and not to the said separating insert, which is removed at the end of the fixing phase.

The lengths of the bar 1 and of the chamber 3 are appropriately greater than that of the printing roller to be treated, so that end portions of a certain length of the membrane 4 do not come into contact with the printing cylinder. The chamber 3 has a width S greater than the width S1 of the plan projection of the working front portion of the membrane 4, this portion coming into contact with the printing cylinder. The depth H of the chamber 3 is greater than the maximum value of the deflection which the lower face of the membrane 4 undergoes when in contact with the printing roller, as specified subsequently with reference to Figure 9.

According to a preferred embodiment of the invention, the marginal parts 104 of the front surface of the membrane 4 are rounded and inclined to form a bevel, so that these parts do not come into contact with the printing cylinder except in transit over the recessed areas of the cylinder, where they form an effective guide. The median part 204 between the said marginal parts 104 may be flat, as illustrated in the drawings, or may have a slight transverse convexity towards the outside, symmetrically with respect to the edges of the chamber 3. The said median part preferably has a width S1 less than the width S of the chamber 3, and preferably corresponds to the following equation:

$$S = S1 + K.S1$$

where K is less than 0.5 and is preferably between 0.25 and 0.1.

By way of example, purely for guidance and without restriction, it may be mentioned that good results have been obtained with a presser designed in the following way: the chamber 3 has a width S of 18 mm and a depth H of approximately 2 mm. The width S1 of the active front surface of the membrane 4 is of the order of 14 mm. The thickness of the membrane 4 is approximately 4 mm in the central area and approximately 2.5 mm at the perimeter. Each of the grooves 107-207 has, ap-

proximately, a width of 3 mm and a depth of 2 mm. The width of the raised edges of the bar, in which the said grooves 107-207 are formed medially, is approximately 6 mm.

In Figure 8, the letters Mf indicate the bending moment of the section of the membrane 4 when the membrane interacts with the printing cylinder R. The sum of the end areas A1-A2 in the graph in Figure 8 is equal to or greater than the median area A3 in the same graph, so that, when the presser is removed from the printing roller and when the contact between this roller and the membrane 4 ceases, the membrane returns elastically to the original position. The force exerted by the membrane on the printing cylinder is of a uniformly distributed type, as indicated by the arrows 10 in Figure 7.

The invention primarily consists in the provision of a presser designed for the specific use described above and in which advantage is taken of the elasticity of a rubber membrane securely fixed at least with its longitudinal edges to corresponding supports, this membrane, when in contact with the printing cylinder, being subjected to composite stresses, predominantly compressive, bending and tensile stresses. In this case the chamber 3 may be open at the ends.

The invention also consists in the provision of a presser in which advantage is taken, in combination with the said elasticity of the membrane, of the effect of the pneumatic counter-pressure 110 (Fig. 7) to which the membrane is subjected when it is mounted with an air-tight seal on the chamber 3 and when the ends of the said membrane are also fixed with an air-tight seal to the corresponding ends of the support bar 1.

Since the fixing of the membrane 4 by vulcanization to the bar 1 requires the temporary covering of the chamber 3 by means of an insert which is then removed, the ends of the chamber 3 may both be open to permit the extraction of the said insert from either of them. These ends are then closed with suitable plugs, fixed for example by vulcanization and made wholly or partly from the same material from which the membrane is made. Alternatively, as illustrated in Figure 3, one end of the chamber 3 may be covered by a raised edge integral with the bar 1, and coplanar with the longitudinal edges of the chamber 3, and provided with a transverse groove 307 which is connected to the said longitudinal grooves 107-207, while the chamber 3 is open at the other end. A blocking insert which projects from the open end of the chamber is housed in the said chamber 3. In these conditions, the membrane 4 is fixed to the three consecutive edges of the bar 1. When the membrane has been fixed on the three sides, the insert is removed from the chamber 3 and the open end

of the said chamber is closed with the corresponding end of the membrane by the fixing of a plug 11. As illustrated in Figure 2, the ends of the membrane 4 are also provided with roundings 104 which are joined to the said longitudinal roundings.

According to a further variant embodiment, illustrated in Figures 4 and 5, the bar 1 may be formed from at least two parts, of which one part, indicated by 101, has an annular shape and has a continuous front annular groove 7, into which the membrane 4 is fixed perimetrically by vulcanization. In this phase, the part 101 is sealed by means of a plug which is provided with anti-cavitation valves and which will be removed subsequently. The part 101 is associated with a part 201 which completes the formation of the bar 1 to hold the movement actuators 5 and which seals the pressure chamber 3 from below and delimits its volume. The parts 101-201 may be fixed together with screws 12 and with a seal 13, the whole being carried out in a way which can be understood and easily performed by those skilled in the art.

As a result of the air-tight sealing of the chamber 3,

$$P_2 = P_1 \times V_1 / V_2 \quad (1)$$

where  $P_2$  is the pressure generated by the compression of the air in the chamber 3,  $P_1$  is the internal resting pressure of the chamber 3 and is equal to atmospheric pressure, and  $V_1$  and  $V_2$  are the volumes of the chamber 3 at rest and in the operating condition in Fig. 7, respectively. In addition,

$$P = P_2 - P_{atm} \quad (2)$$

These equations lead to the following laws of operation. The bending moment  $M_f^*$  to which the section of the elastic membrane 4 is subjected with the chamber 3 sealed and air-tight is less than or equal to the bending moment  $M_f$  of the said membrane section disposed on a chamber 3 open to the outside and therefore always at atmospheric pressure. The pressure  $P_2$  is greater than the atmospheric pressure  $P_{atm}$  and is less than or equal to the pressure which would be present inside the chamber 3, if the elastic resistance of the membrane 4 is assumed to be zero. By changing the physical and geometrical characteristics of the elastic membrane 4 and the volume of the chamber 3, it is possible to make a presser with the best response which conforms to the laws of operation stated above.

When the bar 1 is pressed against the printing cylinder R by the symmetrically disposed actuators indicated by the supports 5-105 in Figure 9, the said bar is deflected until it reaches an equilibrium

position, shown schematically in Figure 9. When the load  $F$  is uniform and substantially free of moments, as in the case of the load exerted by the printing cylinder, concentrations of forces are created at the zero deflection points, while the areas remote from the restraints 5-105 are unloaded and are characterized by deflections greater than zero. This condition could cause a varying cleaning action of the presser, which would be greater in the areas of higher pressure. This condition is not present in the presser according to the invention, since in the areas of greater concentration of load, the rubber of the membrane 4 is deflected further, causing a decrease in the volume of the adjacent section of the chamber 3, with consequent increase in the internal pressure  $P_2$ . The increase in pressure is uniform at every point of the chamber, independently of the new morphology assumed by the beam 1 according to the number and position of the supports 5-105, so that the load exerted by the membrane 4 on the printing cylinder will be uniform. When the load exerted by the actuators 5-105 increases, there is a corresponding decrease in the volume of the chamber 3 and consequently an increase in the uniformly distributed pressure of the membrane 4 on the printing cylinder. The penetration  $C$  of the membrane 4 into the chamber 3, measured at the supports 5-105 and on their axis, is expressed by the following equation:

$$C = 1/2 \cdot f_{max} + (F \cdot H) / (F + L \cdot S) \quad (3)$$

where  $F$  is the load uniformly distributed on the presser,  $f_{max}$  is the maximum deflection of the beam 1 at the supports,  $H-L-S$  are the initial height or depths of the chamber 3, and the length and the width of the said presser chamber respectively. For correct operation of the presser, the following relation is true:

$$f_{max} \times C \times H \quad (4)$$

which describes the optimal range of application of the presser as a function of the maximum deflection  $f_{max}$ , the penetration  $C$  of the membrane 4 and the height  $H$  of the chamber 3.

The invention also relates to a device which has a presser of the type described above and which, as will be seen in Figures 1 and 4, comprises a beam 6, preferably made of light alloy, fixed by its ends to side plates (not illustrated) which can be fixed to the base of the printing machine and can be disposed to support rotatably the cleaning cloth feed and winding shafts.

A longitudinal housing 9, open towards the printing cylinder and parallel to the axis of the latter, is formed in the beam 6 by milling. The bar 1 of the previously described presser is fitted in

this housing with the possibility of movement parallel to the said axis.

The housings for the presser actuators 5-105 are formed in the beam 6. Two holes 10 with steps 110 are formed in the base of the housing 9 and open perpendicularly and in positions symmetrical about the centre. A bottom plug 11 which bears on the annular step 110 is supported in each of these holes, and has passing through it axially the rod 205 which is screwed at one end 1205 into the bar 1 of the pusher and has an integral piston 2205 at its other end. This piston 2205 slides with the annular seal 14 axially and with an air-tight fit in the hole 10.

The number 15 indicates a spring which is interposed between the base cup 11 and the piston 2205 and keeps the presser normally in a withdrawn position. The number 16 indicates a plug which, by means of the seal 17, closes the hole 10 and makes it air-tight and is kept in place by an annular stop 210 and a circlip 18, while it is provided with a threaded through hole 19 for connection to the compressed air supply circuit. The number 100 indicates a vent hole which connects that part of the hole 10 containing the spring 15 to the atmosphere.

In Figure 1 it will be seen that a parallel cavity 20, fitted with a base part 120 of square or rectangular section and with a diverging terminal part 220, is provided in the said beam 6 above the presser housing cavity 9. The base part of the cavity 20 houses a metal bar 21, in whose base wall channels 22 are formed by milling which carry the cleaning liquid to a plurality of equidistant through holes 23 which terminate in corresponding enlarged threaded holes 123 into which the supply nozzles 24, provided with sealing rings 25, are screwed.

To compensate for losses of load, the various branches of the said channels 22 have suitably differing depths and/or widths. The channels 22 start at one end of the bar 21, where they are connected by means of a perpendicular hole 26 to a longitudinal hole 27, into which is screwed a cylindrical sleeve (not illustrated) which passes through a hole in the end of the beam 6 and provides the connection to the cleaning fluid supply circuit.

The bar 21 is inserted into the cavity 20 with the interposition of a flat seal 32, provided with holes for the passage of the screws (not illustrated) which fix the bar 21 to the beam 6.

The geometrical axis of a rectilinear beam, of constant section, subjected to bending, is deformed in a curve (elastic line) contained in the plane of stress and with a curvature depending on the bending moment. The distribution of the tension is always proportional to the distance of the

neutral axis. The deformations are inversely proportional to the moment of inertia of the structure. For this reason, a light alloy beam 6 was chosen as the supporting structure for the presser and for the nozzle support bar. With this solution it is possible to have a rigid structure, inside which the presser housings are formed, for the nozzle support bar and for the actuators 5-105 of the presser.

As will be seen in Figure 1, the material forming the beam 6 is distributed towards the outside with respect to the centre of gravity of the section (point of passage of the neutral axis) and consequently the moment of inertia is large. In this way, for a given weight, the structure is more rigid than in known solutions with a small moment of inertia.

In the modified embodiment illustrated in Figure 10, the membrane 4 of elastomeric material of the presser is provided on its inner surface delimiting the chamber 3, with a reinforcing thin sheet of spring steel 30, which reaches preferably at least to the bottom of the grooves 107, 207.

## Claims

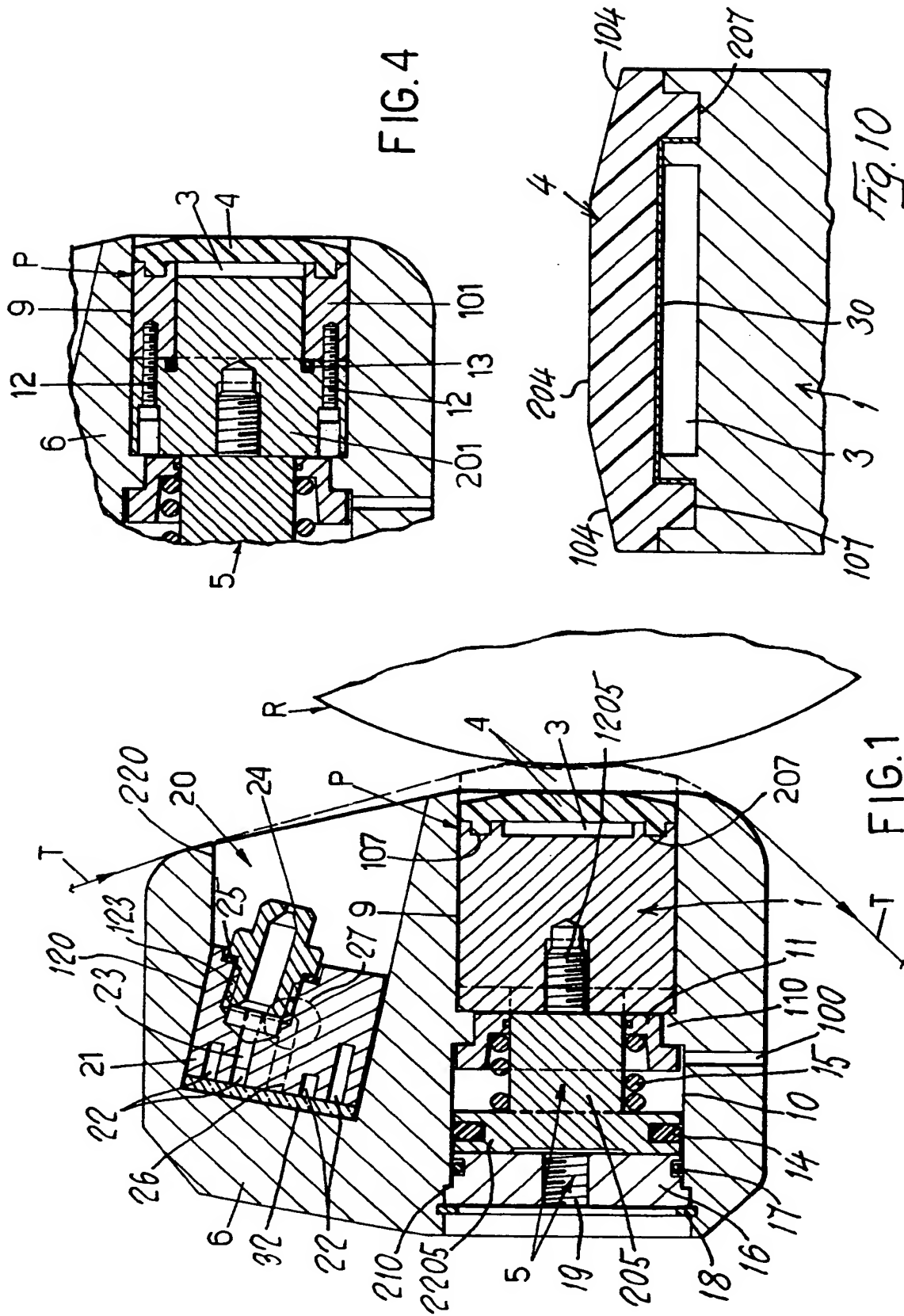
1. Device for cleaning the rubber-covered cylinders of printing machines, of the type comprising a rectilinear presser, with at least one elastically yielding wall, with which the said presser is pushed in a parallel way against the roller to be cleaned, with the interposition of a fabric cloth on which detergent fluid is sprayed, characterized in that the presser comprises a rigid rectilinear bar (1) in whose front side, which is flat and faces the cylinder to be cleaned, there is provided over its whole length a chamber (3) delimited at least by longitudinal and coplanar raised edges disposed to form, in combination with other suitable means, holders for supporting and securing the longitudinal edges of a strong membrane (4) of elastomeric material, whose external surface has a convex transverse profile such that, that part of the said profile which touches the printing cylinder in the cleaning phase has a projection in plan view which falls inside the said chamber and has a length less than that of the chamber, the whole being made in such a way that the membrane is subjected in the active phase to a composite stress which is at least compressive, bending and tensile, the said membrane acting on the printing cylinder with a distributed pressure and ensuring, on the cessation of contact with the cylinder, the complete return of the said membrane to the extended resting state.

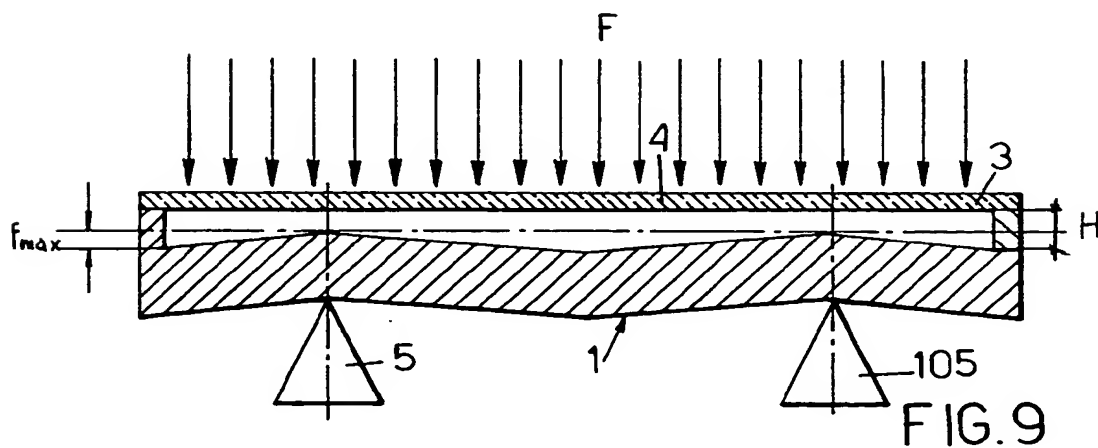
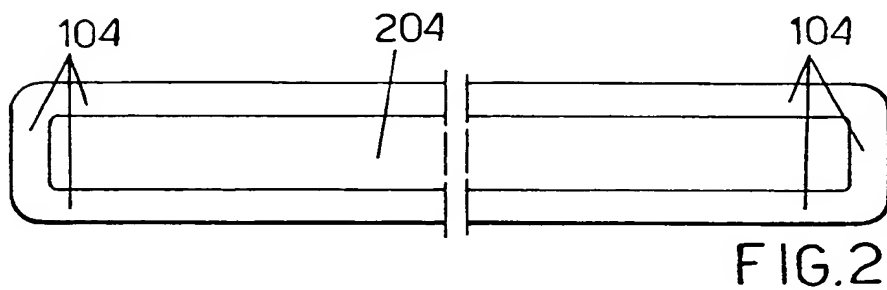
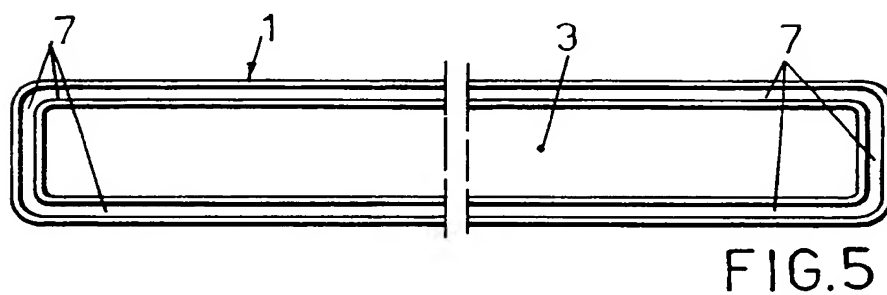
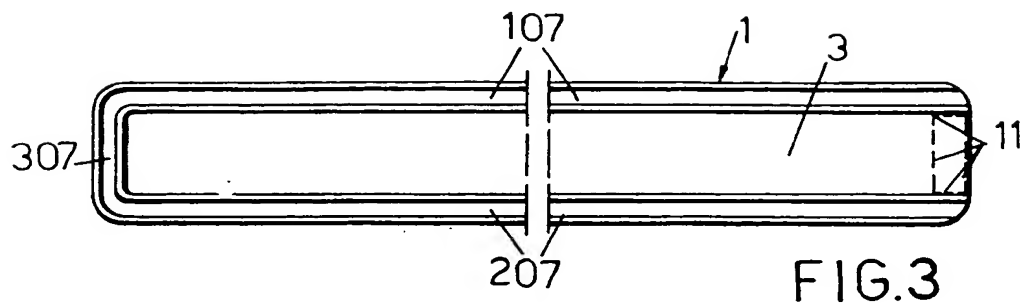
2. Device according to Claim 1, characterized in that the membrane (4) of elastomeric material forming the elastically yielding wall of the presser has substantially a transverse section in the form of an isosceles trapezium, with the smaller wall facing outwards and the width (S1) being related to the width (S) of the underlying chamber (3) by the following equation:  $S = S1 + K.S1$ , where K has a value of less than 0.5 and preferably between 0.25 and 0.1.
3. Device according to Claim 1 or 2, characterized in that the raised edges of the presser chamber (3) on which the membrane (4) of elastomeric material is supported and to which it is fixed, are provided with longitudinal grooves into which enters the material forming the said membrane, which is fixed to the said edges by vulcanization after a blocking insert, which is subsequently removed, has been placed in the chamber.
4. Device according to Claim 1 or Claims 1 to 3, characterized in that the presser chamber has a width of approximately 18 mm, and the useful front surface of the membrane of elastomeric material has a width of approximately 16 mm, while the thickness of the said membrane is of the order of 4 mm in the centre and of the order of approximately 2.5 mm in the peripheral part, and the edges of the presser which support the said membrane have a width of approximately 6 mm, longitudinal and median grooves (107-207) with a depth of approximately 2 mm being formed in these edges, and being substantially as long as the said chamber (3) and approximately 3 mm in width.
5. Device according to Claim 1, characterized in that the membrane (4) of elastomeric material is also fixed by its ends with an air-tight seal to the corresponding ends of the rigid bar (1) of the presser, in such a way that the said membrane is pushed against the printing cylinder and is then additionally forced, at the time of return towards the rest position by the increase in pressure caused by the reduction in the volume of the said chamber as a result of the movement of the said membrane towards the chamber.
6. Device according to Claim 5, characterized in that the presser chamber (3), covered by the membrane (4) of elastomeric material, is in the form of a channel, open initially at both ends, at which it is subsequently closed and sealed with the membrane and by means of suitable plugs, designed for example for fixing by vulcanization.
7. Device according to Claim 5, characterized in that the presser chamber (3), covered by the membrane (4) of elastomeric material, is closed at one end by a raised edge coplanar with the longitudinal raised edges of the said chamber, the said edge having a channel (307) connected at its ends to the ends of the grooves (107-207) of the said longitudinal edges, the material of the membrane fixed on the said edges by vulcanization being engaged in this channel, while the other end of the chamber is open for the insertion and removal of the temporary blocking insert, this end being closed subsequently with a plug (11) designed for fixing by vulcanization to the corresponding end of the said membrane.
8. Device according to Claim 5, characterized in that the presser chamber (3), covered by the membrane (4) of elastomeric material, consists of an annular body (101) within whose front surface for supporting and fixing the membrane there is provided a continuous groove (7) into which the said membrane is fixed, the said annular body being closed, in the phase of fixing the membrane, by means of an insert which is subsequently removed from the face opposite that engaged by the membrane, on which face the body is subsequently closed by means of another body (201) and if necessary a seal (13) which complete the formation of the parts of the presser bar for connection to the means of movement (5).
9. Device according to one or more of the preceding claims, characterized in that the design of the presser bar, the movement of the bar and the design of the membrane (4) of elastomeric material, as well as the shaping of this membrane and the design of the chamber (3) closed by means of the membrane, are preferably such that the maximum deflection (fmax) of the said bar at the points at which it is supported on the movement actuators (5-105) is less than the penetration (C) of the membrane into the air chamber at the points of the said supports, and is similarly less than the height and initial depth (H) of the air chamber.
10. Device according to one or more of the preceding claims, characterized in that the presser bar (1) is housed, with the possibility of movement parallel to its axis, in a cavity (9) formed by a rigid beam (6), preferably made of light alloy, in which are formed the housings

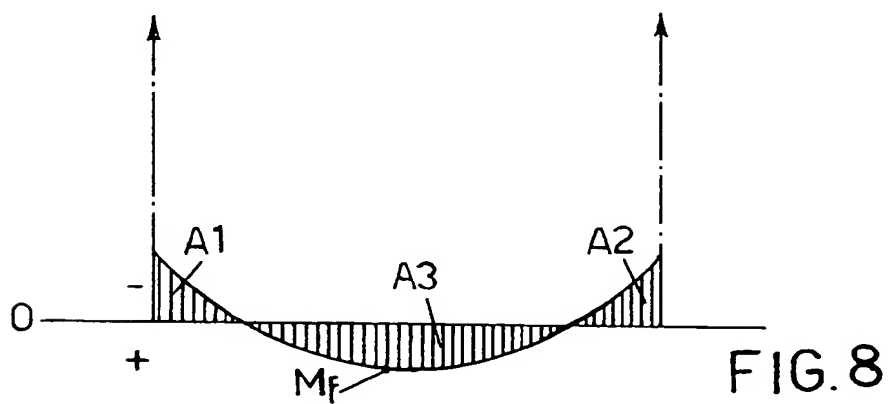
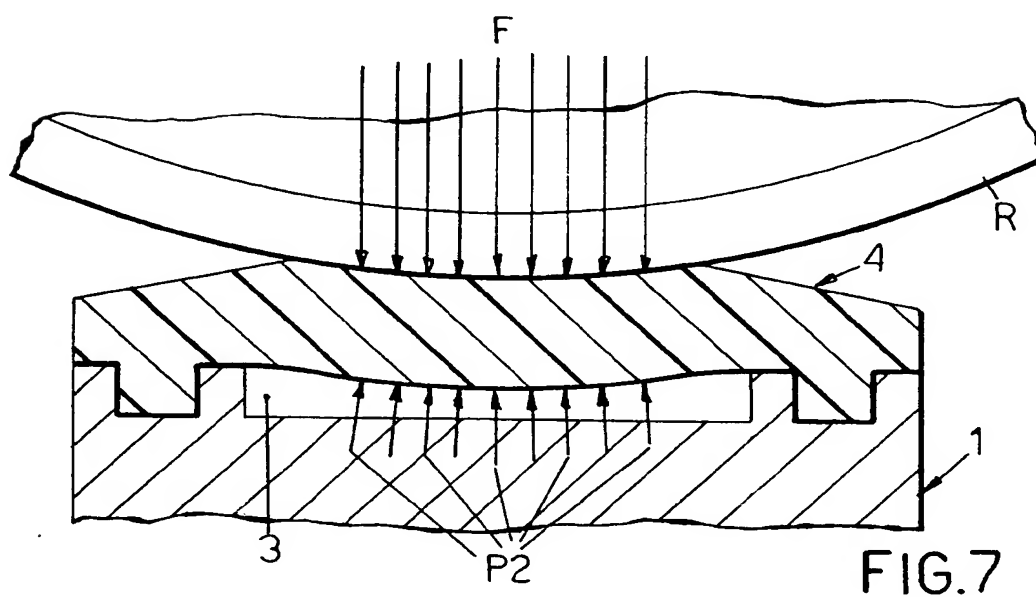
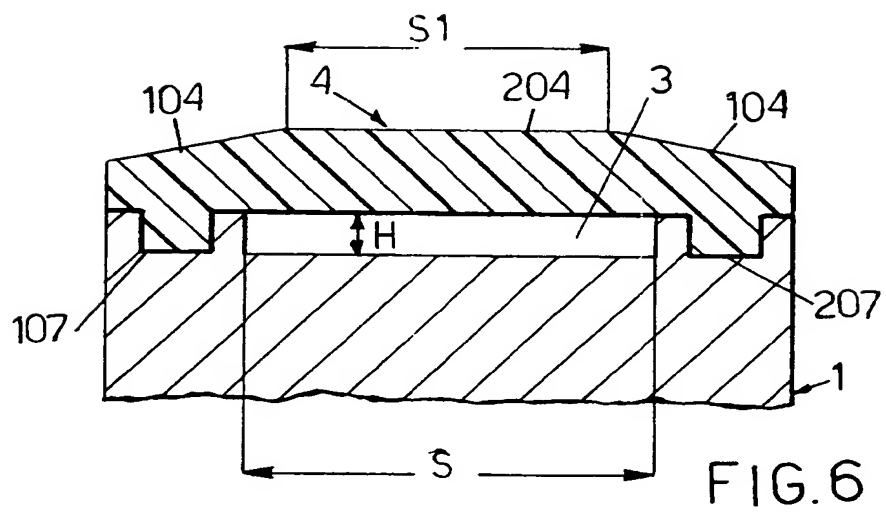
(10) for the actuator cylinders (5-105) operating by fluid pressure which move the presser parallel to the axis of the printing cylinder to be cleaned.

11. Device according to Claim 10, characterized in that the housings (1) for the presser actuator cylinders comprise a cylindrical chamber in which the single-acting actuator piston (2205) moves with an air-tight seal. 5  
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12. Device according to one or more of the preceding claims, characterized in that a longitudinal cavity (20) which houses equidistant nozzles (24) for spraying the detergent fluid, connected to a circuit formed inside the said beam and connected to at least one external duct for the supply of the said fluid under pressure, is formed in the light alloy beam (6) which supports and guides the presser, above the presser and parallel to it. 15  
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13. Device according to Claim 12, characterized in that the detergent fluid supply nozzles are mounted on a bar (21) housed on the base of a containing cavity (20) formed in the light alloy beam (6), while the holes (23) feeding the nozzles (24) communicate with channels (22) formed by milling in the rear wall of the said bar (21) and closed by means of a flat seal (32) with which the bar is fixed, by means of screws, on the base (120) of the said containing cavity. 25  
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14. Device according to Claim 13, characterized in that the channels (22) formed in the base of the nozzle support bar (21) have a symmetrical design and have differing widths and/or depths in order to compensate for losses of load and to ensure uniform supply of the detergent fluid to all the nozzles (24). 35  
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15. Device according to one or more of the preceding claims, characterized in that the membrane (4) of elastomeric material of the presser (1) is provided on its inner side delimiting the chamber (3), with a reinforcing thin sheet of spring steel (30), which reaches preferably at least to the bottom of the grooves (107, 207). 45  
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## EUROPEAN SEARCH REPORT

Application Number  
EP 94 11 1126

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP-A-0 446 668 (HEIDELBERGER) * column 5, line 23 - column 8, line 4; figures 1-5 * -----	1	B41F35/06
			TECHNICAL FIELDS - SEARCHED (Int.Cl.6)
			B41F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20 October 1994	Examiner Loncke, J
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document			

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